

REMARKS/ARGUMENTS

The Applicants originally submitted Claims 1-21 in the application. No claims have been added, amended or cancelled. Accordingly, Claims 1-21 are pending in the application.

I. Formal Matters and Objections

The Examiner has requested the background reference “Introduction to Numerical Analysis.” Accordingly, the Applicants have provided a copy of the table of contents and relevant pages with this response. The provided pages, however, do not limit the incorporation by reference but are simply provided to meet the Examiner’s requirement. If more sections are needed by the Examiner, the Applicants will gladly supply.

Additionally, the Examiner has objected to Figure 2B submitted with the previous response asserting the introduction of new matter. More specifically, the Examiner asserts Figure 2 introduces new matter by allowing the charge distribution to not be within acceptable limits, but yet not perform subdivisions. The Examiner cites page 11, lines 18-20 of the specification for support. (Examiner’s Action, page 3). The Applicants respectfully disagree.

As stated on page 18, line 12, to page 24, line 17, subdivisions of the geometry are not required to obtain a charge distribution function within an acceptable limit as reflected in Figure 2B. For example, the iterative linear solution method of the present invention employs a recursive method that would not require geometry subdivisions when the charge distribution function applied to the first guess geometry is within acceptable limits. (Page 11, lines 13-18). This is reflected in Figure 2B, which provides a representation of the recursive nature of the iterative linear solution method. Furthermore, the Examiner’s cite from the specification does not mandate that a geometry

must be subdivided to obtain a charge distribution function within an acceptable limit. Instead, the cite pertains to a discussion of Figure 2A which is a block diagram illustrating the interaction of components of a system for determining a capacitance of an integrated circuit (IC). A more detailed discussion of each block follows the cite including obtaining a charge distribution function within an acceptable limit that does not necessarily require subdividing of the geometry.

The Applicants, however, have amended Figure 2B to provide better clarity in view of the specification. Accordingly, the Applicants have amended the discussion of Figure 2B in the specification to correspond to the drawing amendment. The Applicants have also re-inserted the discussion of Figure 2B in the specification to improve the continuity of the specification. The Applicants, therefore, respectfully request that the Examiner remove the objection to the drawings in view of the above discussion and amendments.

The Examiner has also objected to the specification regarding the description of C3 as a coarse geometric description in the paragraph beginning on Page 10, lines 4-9. (Examiner's Action, pages 4-5). The cited paragraph is directed toward an example of the amount of detail that may be determined for each net. The cited paragraph is not describing the current state of the nets. In addition, the description of Figures 3A and 3B disclose how the nets of Figure 1 can be captured with a relatively detailed geometric description. However, to further the prosecution and help explain the example, the Applicants have amended the specification and Figure 1.

Additionally, the Examiner has objected to the paragraph at Page 4, lines 9-14 as being unclear, ambiguous and possibly contradictory. (Examiner's Action, pages 5-6). In response, the Applicants have amended the specification to provide better clarity. Accordingly, the Applicants

respectfully request the Examiner remove the above objections to the specification in view of the amendments.

II. Rejection of Claims 1-21 under 35 U.S.C. §112

The Examiner has rejected Claims 1-21 under the first paragraph of 35 U.S.C. §112 for not being enabled. Specifically, the Examiner asserts that the present invention does not enable a charge variation function independent of a conductive geometry. (Examiner's Action, page 7). The Applicants respectfully agree.

The specification asserts that the geometry of nets of a capacitive structure do not need to be accurately captured to provide a capacitance calculation. Instead, simpler geometric descriptions of nets may be used instead of the exact geometry of nets to reduce the number of unknowns. Additionally, the charge variation may be decoupled from the geometry of the nets meaning that the charge variation may be determined separately from the geometry. (Page 9, lines 8-22). The charge variation function may be created by the charge variation function generator 220 for a particular subdivision of the geometry and the conductive geometry generator 230 may generate an advantageous description of the geometry of the capacitive structure by performing adaptive subdivisions of the nets. (Page 12, lines 8-19). A charge variation function, therefore, may be created for a subdivision of the geometry instead of for the exact geometry of the net. Accordingly, a charge variation function may be independent of the exact conductive geometry of the capacitive structure but instead may be created for an advantageous geometry description.

Additionally, the Examiner asserts that charge variation function and charge distribution function are used interchangeably, that the charge distribution function is determined based upon

the initial charge distribution and geometry, and that refine charge variation function may be determined based upon subdivisions of geometry. (Examiner's Action, pages 6-7). In response, the Applicants have amended Figure 2B and the corresponding discussion and refer to the arguments below.

A charge distribution function and a charge variation function are not interchangeable terms. On the contrary, a charge variation function is a function that is used to modify the charge distribution function to reach a desired resolution. Unlike the initial charge distribution, the first charge variation function f_1 is the difference between a desired potential ψ_0 and the potential ψ . (Page 17, lines 14-19).

Furthermore, Figure 2B does not illustrate that the charge variation function may be determined based on subdivided geometries. Instead, Figure 2B illustrates determining the charge distribution function (270) for a new subdivision (290) after determining a geometry refinement (287) was needed. If needed, a charge variation function is created to refine the charge distribution function (280) associated with the new subdivision. The charge variation function, however, is not derived based on the new subdivision but is created using equation 10 as discussed in the specification. (Page 18, line 15 to Page 20, line 15).

Accordingly, the Applicants request that the Examiner remove the rejection of Claims 1-21 under the first paragraph of 35 U.S.C. §112 in view of the above discussion and amendment.

III. Rejection of Claims 1 and 8 under 35 U.S.C. §102

The Examiner has rejected Claims 1 and 8 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,397,171 to Belk. In the Examiner's Action, the Examiner agrees that Belk does

not teach a charge variation function that is independent of a conductive geometry of the capacitive structure. However, the Examiner maintains the Belk rejection based on the assertion that the present invention does not enable a charge variation function that is independent of a conductive geometry. As argued above and in conjunction with the clarifying amendments, the Applicants respectfully disagree and still maintain that Belk does not teach each and every element of independent Claims 1 and 8 by reasserting the following arguments.

Belk teaches modeling metalization structures by selecting representative sub units and using the self and mutual interactions of the sub units as an initial solution to describe all interactions between similar metalization sub units in an overall system of metals. (Abstract). The sub units are a system of structures including straight polygons, bends and intersections which are decomposed from the metalization structure. (Column 6, lines 21).

Belk does not teach, among other things, a system for generating a representation of charge distribution for a given capacitive structure including creating a multidimensional charge variation function that is independent of a conductive geometry of the capacitive structure. (Claims 1 and 8). As defined in the present specification, a charge variation function is not a representation of a charge distribution but is a function used to modify the charge distribution function to reach a desired resolution. (Page 23, lines 4-6). Instead of charge variation functions, Belk merely teaches charge distributions that are determined for representative subunits of the metalization structure. (Column 1, lines 55-62). The charge distribution functions on each subunit may be decomposed into mathematical functions that capture the differing properties of the components of the charge distributions. (Column 12, lines 31-37). Additionally, the charge distributions are

dependent on the subunits which are decomposed structures from the metalization structure. The charge distribution, therefore, is dependent on a conductive geometry of the metalization structure.

Since Belk does not teach creating a multidimensional charge variation function that is independent of a conductive geometry of the capacitive structure, Belk, therefore, does not disclose each and every element of the claimed invention associated with independent Claims 1 and 8. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102(e) rejection with respect to Claims 1 and 8.

IV. Rejection of Claims 2-7 and 9-21 under 35 U.S.C. §103

The Examiner has rejected Claims 2-7 and 19-21 under 35 U.S.C. §103(a) as being unpatentable over Belk in view of U.S. Patent 6,175,815 to Statzler, a journal article written by K. Nabors (Nabors), U.S. Patent 6,345,235 to Edgecomb, *et al.* (Edgecomb), U.S. Patent 6,351,572 to Dufour or a combination of thereof. The Applicants respectfully disagree and reassert the following arguments.

As discussed above, Belk does not teach creating a multidimensional charge variation function that is independent of a conductive geometry of the capacitive structure as recited in independent Claims 1 and 8. Since Claim 15 has analogous claim limitations as in Claims 1 and 8, Belk also fails to teach the Applicants claimed invention as recited in Claim 15. Additionally, Belk does not suggest creating a multidimensional charge variation function that is independent of a conductive geometry of the capacitive structure. In contrast, Belk merely teaches determining charge distribution by decomposing a metalization structure into subunits. Statzler, Nabors,

Edgecomb and Dufour also fail to teach or suggest creating a multidimensional charge variation function that is independent of a conductive geometry of the capacitive structure.

As discussed above, Belk fails to teach or suggest all of the elements of the inventions recited in independent Claims 1, 8 and 15. Since Statzler, Nabors, Edgecomb and Dufour fail to cure the deficiencies of Belk, the Examiner cannot establish a *prima facie* case of obviousness of dependent Claims 2-7 and 9-21, which include the elements of the respective independent claims. Therefore, the inventions as stated in Claims 2-7 and 9-21 are not obvious over Belk in view of Statzler, Nabors, Edgecomb and Dufour since Belk, Statzler, Nabors, Edgecomb and Dufour, individually or in combination with one another, do not teach or suggest all of the claim elements. Accordingly, the Applicants respectfully request the Examiner withdraw the 103(a) rejection and pass Claims 2-7 and 9-21 to issue.

V. Conclusion

In view of the foregoing amendment and remarks, the Applicants now see all of the Claims currently pending in this application to be in condition for allowance and therefore earnestly solicits a Notice of Allowance for Claims 1-21. Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

The Applicants request the Examiner to telephone the undersigned attorney of record at (972) 480-8800 if such would further or expedite the prosecution of the present application.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

(1) Kindly replace the paragraph beginning on page 10, line 4 with the following paragraph:

--The geometry of the nets C1, C2, C3 is described hierarchically and captured to a level of detail needed to determine an accurate solution. For example, in FIGURE 1, since the net C2 is located close to the net C1, the net C1 and the net C2 are captured with relatively detailed geometric descriptions. However, since the net C3 is located far enough away from the net C1, then the net C3 may be captured with relatively coarse geometric descriptions.--

(2) Kindly replace the paragraph beginning on page 4, line 2 with the following paragraph:

--To address the above-discussed deficiencies of the prior art, the present invention provides, for use in an integral equation formulation of capacitance, a system for, and method of, generating a representation of charge distribution for a given capacitive structure (which may be an integrated circuit). In one embodiment, the system includes: (1) a charge variation function generator that creates a multidimensional charge variation function wherein the charge variation function [that] is independent of a conductive geometry of the structure and (2) a conductive geometry generator, associated with the charge variation generator, that creates a conductive geometry wherein the conductive geometry [that] is independent of charge variation in the

structure[,] . Both the charge variation function and the conductive geometry are employable in the integral equation formulation to reduce a complexity thereof.--

(3) Kindly cancel the eight paragraphs that were previously inserted after the paragraph that ended on page 24, line 10.

(4) Kindly insert the following paragraphs after the paragraph that ends on page 25, line 17 of the original specification.

--Turning now to FIGURE 2B with continued reference to FIGURE 2A, illustrated is a flow diagram of an embodiment of a method of determining a charge distribution for a net, generally designated 250, constructed according to the principles of the present invention. The method starts in a step 255 with an intent to determine a charge distribution.

An initial charge distribution and geometry are provided in a step 260. The initial charge distribution and the initial geometry may be guesses and are used to start an iterative linear solution. The initial guess for the charge distribution may be designated g and the initial guess for the geometry may be a subdivision of the geometry of the net.

After an initial charge distribution and geometry are provided, a first charge variation function is then determined in a step 265. The first charge variation function, f_1 , may be the difference between ψ_0 and ψ . In one embodiment, the first charge variation function may be determined by solving for ψ_0 and ψ using Equations 6 and 9.

After determining the first charge variation function, a determination is made if the charge distribution function is within an acceptable limit in a first decisional step 270. In one embodiment, the acceptance of the charge distribution function may be within an acceptable limit

if the ratio γ/β is sufficiently small. If the charge distribution function is within an acceptable limit, the method 250 ends in a step 295.

If the charge distribution function is not within an acceptable limit, a charge variation function is created to refine a description of the charge distribution function in a step 280. In one embodiment, f_1 may be normalized before proceeding with the linear iterative method. The method 250 creates a charge variation function which refines the description of the charge distribution function employing Equations 10-17.

After refining the description of the charge distribution function, a determination is made if the charge distribution function is within an acceptable limit in a step 282. In one embodiment, the charge distribution function is within an acceptable limit based on the ratio r/β . If the ratio is within acceptable limits, the charge distribution has converged and the method 250 continues to step 295 and ends.

If the charge distribution function is not within acceptable limits, a determination is made if the geometry needs refinement in a third decisional step 287. In one embodiment, the method 250 may employ Equations 18 and 19 to determine if the geometry needs refinement. If the geometry does not need refinement, the method continues to step 280. If the geometry does need refinement, the geometry is subdivided into subdivisions in a step 290. After subdividing the geometry, the method 250 continues to the step 280.

While the methods disclosed herein have been described and shown with reference to particular steps performed in a particular order, it will be understood that these steps may be combined, subdivided or reordered to form an equivalent method without departing from the

teachings of the present invention. Accordingly, unless specifically indicated herein, the order
and/or the grouping of the steps are not limitations of the present invention.--